IN THE CLAIMS:

A marked-up copy of the claims is provided at the end of applicant's response. A clean copy of the claims are provided below for the Examiner's convenience.

1. (UNCHANGED) A method for automatically detecting and diagnosing impairment in a communication service, the method comprising:

a) detecting events that occur in a plurality of in domain communication channels where each channel is used by a communication service; and

b) determining the probability of each of a plurality of possible causes as being a cause of interference in a victim channel, by propagating observations of the interference backwards through a Bayesian Belief Network (BBN) which defines a probabilistic cause-effect relationship between each cause and each effect.

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2. (NEW) A method for impairment diagnosis in a communication system comprising:

performing training on the communication system;

performing event detection on the communication system;

performing event clustering on the communication system; and

performing event analysis on the communication system.

3. (NEW) The method of claim 2 wherein performing event analysis includes hypothesis testing.

4. (NEW) The method of claim 2 wherein performing event analysis includes determining cause-effect relationships.

5. (NEW) The method of claim 4 wherein the cause-effect relationships are represented as Bayesian Belief Networks.

6. (NEW) The method of claim 2 wherein the method further comprises:
performing disturbance classification.

7. (NEW) The method of claim 2 wherein impairment diagnosis is performed for a single disturber.

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8. (NEW) The method of claim 2 wherein impairment diagnosis is performed for multiple disturbers.

9. (NEW) The method of claim 8 wherein the impairment diagnosis is ranked by contribution of each disturber.

10. (NEW) A method for training a communication comprising:
defining at least two types of inputs;
performing initialization;
performing a state update;
calculating a coupling estimate; and
performing matrix reordering.

11. (NEW) The method of claim 10 wherein the at least two types of inputs are service types of the communication system.

12. (NEW) The method of claim 10 wherein initialization is performed on a connectivity matrix.

13. (NEW) The method of claim 10 wherein matrix reordering is performed using a symmetric sparse matrix reordering algorithm.

14. (NEW) The method of claim 13 wherein the symmetric sparse matrix reordering algorithm is a Cuthill-McKee algorithm.

15. (NEW) The method of claim 13 wherein the symmetric sparse matrix reordering algorithm is a Minimum Degree algorithm.

16. (NEW) The method of claim 10 wherein the method further comprises:

performing pre-initialization on an initial estimate of a connectivity matrix prior to performing initialization.

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17. (NEW) The method of claim 16 wherein the initial estimate of the connectivity matrix is derived from binder information.

18. (NEW) A method to determine the probability that a victim channel is interfered with by an offender channel comprising:

monitoring events and causes on a channel;

correlating events and causes; and

postulating out-of-domain offenders based upon in-domain activity.

19. (NEW) A method for forced training of a communication system comprising:

determining a combination of inputs for a communication system;

applying at least one mode change to the communication system; and

processing resulting outputs from the communication system.

20. (NEW) The method of claim 19 wherein more than one mode change is applied sequentially to the communication system.

21. (NEW) The method of claim 19 wherein more than one mode change is applied in a combination to the communication system.

22. (NEW) An actuation sequencing method comprising:

instructing at least one communication channel to go into idle mode;

observing a corresponding SNR increase on other communication channels;

constructing an initial estimate of the configuration of the communication system using a connectivity matrix;

identifying any non-zero elements of the connectivity matrix;

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23. (NEW) The method of claim 22 further comprising:

using at least one natural input signal and at least one natural output signal to improve the estimates of the connectivity matrix.

24. (NEW) The method of claim 22 wherein the connectivity matrix is identified over a limited number of frequency ranges.

25. (NEW) A system for event detection comprising:

a signal transform block for converting a raw data from a monitored channel into a desired form;

a data reduction block coupled to the signal transform block for reducing the number of variables for non-aggregate data;

a main channel transfer function (MCTF) drift monitor block coupled to the signal transform block for estimating a drift rate for a main channel transfer function;

at least one interacting multiple model (IMM) filter block coupled to the data reduction block and the MCTF drift monitor block for modeling a change on a channel; and

at least one gating function block coupled to the at least one IMM filter block for creating a record of a change on a channel.

26. (NEW) The system of claim 25 wherein a desired form is a time waveform.

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27. (NEW) The system of claim 25 wherein a desired form is a spectrum of a transmit signal power for an offender.

28. (NEW) The system of claim 25 wherein a desired form is a noise power for a victim.

29. (NEW) The system of claim 25 wherein the data reduction block uses spectral compression.

30. (NEW) A method comprising:

1) determining the number of disturber signals on a channel;

2) generating an ideal disturber signal model of an ideal disturber signal for each of the disturber signals;

3) comparing the ideal disturber signal model with an actual signal on the channel to generate an estimation of a co-channel of the disturber signal; and

4) repeating steps 1)-3) as necessary until all the co-channels of the disturbers are identified.

31. (NEW) The method of claim 30 further comprising:

detecting a service type existence.

32. (NEW) The method of claim 31 wherein the service type existence is detected by identifying/characterizing at least one disturber signal on the channel.

33. (NEW) The method of claim 31 wherein detecting the service type existence is focused on at least one particular frequency range in a case where it is known that a particular service type may cause a disturbance on the channel.

34. (NEW) The method of claim 30 wherein determining the number of disturber signals on the channel includes:

determining a disturber/noise power, wherein if the disturber power is above a critical threshold;

identifying a source of the disturber; and

identifying a frequency of the disturber.

35. (NEW) The method of claim 30 further comprising:

prioritizing the sources of the disturbers from highest to lowest disturber power.

36. (NEW) A method comprising:

1) detecting a service type existence;

2) determining the number of disturber signals on the channel, including:

determining a disturber/noise power, wherein if the disturber power is above a critical threshold;

identifying a source of the disturber; and

identifying a frequency of the disturber;

3) generating an ideal disturber signal model of a spectral content of an ideal disturber signal for each at least one disturber signal;

4) comparing the ideal disturber signal model with an actual signal on the channel to generate an estimation of a co-channel of the disturber signal; and

5) repeating steps 1)-4) as necessary until all sources of the disturbers are identified.

37. (NEW) The method of claim 36 wherein the service type existence is detected by identifying/characterizing at least one disturber signal on the channel.

38. (NEW) The method of claim 36 wherein detecting the service type existence is focused on at least one particular frequency range in a case where it is known that a particular service type may cause a disturbance on the channel.

39. (NEW) The method of claim 36 further comprising:

prioritizing the sources of the disturbers from highest to lowest disturber power.

40. (NEW) A method comprising:

collecting a notification of at least one event from a transceiver at a line card;

reporting the notification of the event from the transceiver to a DSLAM control unit; and

sending the notification from the DSLAM control unit to a network management agent.

41. (NEW) The method of claim 40 further comprising:

correlating the event with other events at the line card prior to reporting the notification to the DSLAM control unit.

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42. (NEW) The method of claim 40 wherein the notification of the event is time stamped by the transceiver.

43. (NEW) The method of claim 40 wherein the notification of the event is time stamped by the line card.

44. (NEW) The method of claim 40 further comprising:

correlating the events with other events reported by other line cards at the DSLAM control unit prior to sending the notification to the network management agent.

45. (NEW) The method of claim 40 further comprising:

prioritizing the events with other events reported by other line cards at the DSLAM control unit prior to sending the notification to the network management agent.

46. (NEW) The method of claim 40 further comprising:

correlating the events with other events reported by other DSLAM control units at the network management agent.

47. (NEW) The method of claim 40 further comprising:

prioritizing the events with other events reported by other DSLAM control units at the network management agent.

48. (NEW) The method of claim 40 wherein an event is an observed change in a signal-to-noise ratio on a line.

49. (NEW) The method of claim 40 wherein an event is a change in a bit error rate.

50. (NEW) The method of claim 40 wherein an event is a change in any measurement of signal quality.

51. (NEW) The method of claim 40 wherein an event is a change in a transmitter's signal power on a line.

52. (NEW) The method of claim 40 wherein an event is a change in a transmitted bit rate speed for a line.

53. (NEW) A system comprising:

at least one transceiver, wherein the transceiver monitors for an event;

at least one line card, wherein the line card collects the events of the transceiver and correlates the events;

at least one DSLAM control unit, wherein the DSLAM control unit receives a notification of the events of the transceiver and correlates and prioritizes the event with other events received from other transceivers; and

a network management agent, wherein the network management agent receives a correlated and prioritized notification of events from the DSLAM control unit and further correlates and prioritizes the events with other events received from other DSLAM control units.

54. (NEW) The system of claim 53 wherein an event is an observed change in a signal-to-noise ratio on a line.

55. (NEW) The system of claim 53 wherein an event is a change in a bit error rate.

56. (NEW) The system of claim 53 wherein an event is a change in any measurement of signal quality.

57. (NEW) The system of claim 53 wherein an event is a change in a transmitter's signal power on a line.

58. (NEW) The system of claim 53 wherein an event is a change in a transmitted bit rate speed for a line.

59. (NEW) The system of claim 53 wherein the line card is capable of time stamping the event.

60. (NEW) A computer readable medium containing executable instructions which, when executed in a processing system, causes said system to perform a method for impairment diagnosis in a communication system, the method comprising:

performing training on the communication system;

performing event detection on the communication system;

performing event clustering on the communication system; and

performing event analysis on the communication system.

61. (NEW) The computer readable medium of claim 60 wherein performing event analysis includes hypothesis testing.

62. (NEW) The computer readable medium of claim 60 wherein performing event analysis includes determining cause-effect relationships.

63. (NEW) The computer readable medium of claim 62 wherein the cause-effect relationships are represented as Bayesian Belief Networks.

64. (NEW) The computer readable medium of claim 60 wherein the method further comprises:

performing disturbance classification.

65. (NEW) The computer readable medium of claim 60 wherein impairment diagnosis is performed for a single disturber.

66. (NEW) The computer readable medium of claim 60 wherein impairment diagnosis is performed for multiple disturbers.

67. (NEW) The computer readable medium of claim 66 wherein the impairment diagnosis is ranked by contribution of each disturber.

68. (NEW) A computer readable medium containing executable instructions which, when executed in a processing system, causes said system to perform a method for training a communication system, the method comprising:

defining at least two types of inputs;
performing initialization;
performing a state update;
calculating a coupling estimate; and
performing matrix reordering.

69. (NEW) The computer readable medium of claim 68 wherein the at least two types of inputs are service types of the communication system.

70. (NEW) The computer readable medium of claim 68 wherein initialization is performed on a connectivity matrix.

71. (NEW) The computer readable medium of claim 68 wherein matrix reordering is performed using a symmetric sparse matrix reordering algorithm.

72. (NEW) The computer readable medium of claim 68 wherein the method further comprises:

performing pre-initialization on an initial estimate of a connectivity matrix prior to performing initialization.

73. (NEW) The computer readable medium of claim 72 wherein the initial estimate of the connectivity matrix is derived from binder information.

74. (NEW) A computer readable medium containing executable instructions which, when executed in a processing system, causes said system to perform a method for actuation sequencing in a communication system, the method comprising:

instructing at least one communication channel to go into idle mode;

observing a corresponding SNR increase on other communication channels;

constructing an initial estimate of the configuration of the communication system using a connectivity matrix;

identifying any non-zero elements of the connectivity matrix;

75. (NEW) The computer readable medium of claim 74 further comprising:

using at least one natural input signal and at least one natural output signal to improve the estimates of the connectivity matrix.

76. (NEW) The computer readable medium of claim 74 wherein the connectivity matrix is identified over a limited number of frequency ranges.

77. (NEW) A computer readable medium containing executable instructions which, when executed in a processing system, causes said system to perform a method, the method comprising:

1) determining the number of disturber signals on a channel;

2) generating an ideal disturber signal model of an ideal disturber signal for each of the disturber signals;

3) comparing the ideal disturber signal model with an actual signal on the channel to generate an estimation of a co-channel of the disturber signal; and

4) repeating steps 1)-3) as necessary until all the co-channels of the disturbers are identified.

78. (NEW) The computer readable medium of claim 77 further comprising:

detecting a service type existence.

79. (NEW) The computer readable medium of claim 78 wherein the service type existence is detected by identifying/characterizing at least one disturber signal on the channel.

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80. (NEW) The computer readable medium of claim 78 wherein detecting the service type existence is focused on at least one particular frequency range in a case where it is known that a particular service type may cause a disturbance on the channel.

81. (NEW) The computer readable medium of claim 77 wherein determining the number of disturber signals on the channel includes:

determining a disturber/noise power, wherein if the disturber power is above a critical threshold;

identifying a source of the disturber; and

identifying a frequency of the disturber.

82. (NEW) The computer readable medium of claim 77 further comprising:

prioritizing the sources of the disturbers from highest to lowest disturber power.

83. (NEW) A computer readable medium containing executable instructions which, when executed in a processing system, causes said system to perform a method, the method comprising:

collecting a notification of at least one event from a transceiver at a line card;

reporting the notification of the event from the transceiver to a DSLAM control unit; and

sending the notification from the DSLAM control unit to a network management agent.

84. (NEW) The computer readable medium of claim 83 further comprising:

correlating the event with other events at the line card prior to reporting the notification to the DSLAM control unit.

85. (NEW) The computer readable medium of claim 83 wherein the notification of the event is time stamped by the transceiver.

86. (NEW) The computer readable medium of claim 83 wherein the notification of the event is time stamped by the line card.

87. (NEW) The computer readable medium of claim 83 further comprising:

correlating the events with other events reported by other line cards at the DSLAM control unit prior to sending the notification to the network management agent.

88. (NEW) The computer readable medium of claim 83 further comprising:

prioritizing the events with other events reported by other line cards at the DSLAM control unit prior to sending the notification to the network management agent.

89. (NEW) The computer readable medium of claim 83 further comprising:

correlating the events with other events reported by other DSLAM control units at the network management agent.

90. (NEW) The computer readable medium of claim 83 further comprising:

prioritizing the events with other events reported by other DSLAM control units at the network management agent.

91. (NEW) The computer readable medium of claim 83 wherein an event is an observed change in a signal-to-noise ratio on a line.

92. (NEW) The computer readable medium of claim 83 wherein an event is a change in a bit error rate.

93. (NEW) The computer readable medium of claim 83 wherein an event is a change in any measurement of signal quality.

94. (NEW) The computer readable medium of claim 83 wherein an event is a change in a transmitter's signal power on a line.

95. (NEW) The computer readable medium of claim 83 wherein an event is a change in a transmitted bit rate speed for a line.

96. (NEW) An article of manufacture comprising a program storage medium readable by a computer and tangibly embodying at least one program of instructions executable by said computer to perform a method, the method comprising:

1) determining the number of disturber signals on a channel;

2) generating an ideal disturber signal model of an ideal disturber signal for each of the disturber signals;

3) comparing the ideal disturber signal model with an actual signal on the channel to generate an estimation of a co-channel of the disturber signal; and

4) repeating steps 1)-3) as necessary until all the co-channels of the disturbers are identified.

97. (NEW) The article of manufacture of claim 96 further comprising:

detecting a service type existence.

98. (NEW) The article of manufacture of claim 97 wherein the service type existence is detected by identifying/characterizing at least one disturber signal on the channel.

99. (NEW) The article of manufacture of claim 97 wherein detecting the service type existence is focused on at least one particular frequency range in a case where it is known that a particular service type may cause a disturbance on the channel.

100. (NEW) The article of manufacture of claim 96 wherein determining the number of disturber signals on the channel includes:

determining a disturber/noise power, wherein if the disturber power is above a critical threshold;

identifying a source of the disturber; and

identifying a frequency of the disturber.

101. (NEW) The article of manufacture of claim 96 further comprising:

prioritizing the sources of the disturbers from highest to lowest disturber power.

102. (NEW) An article of manufacture comprising a program storage medium readable by a computer and tangibly embodying at least one program of instructions executable by said computer to perform a method, the method comprising:

collecting a notification of at least one event from a transceiver at a line card;

reporting the notification of the event from the transceiver to a DSLAM control unit; and

sending the notification from the DSLAM control unit to a network management agent.

103. (NEW) The article of manufacture of claim 102 further comprising:

correlating the event with other events at the line card prior to reporting the notification to the DSLAM control unit.

104. (NEW) The article of manufacture of claim 102 wherein the notification of the event is time stamped by the transceiver.

105. (NEW) The article of manufacture of claim 102 wherein the notification of the event is time stamped by the line card.

106. (NEW) The article of manufacture of claim 102 further comprising:

correlating the events with other events reported by other line cards at the DSLAM control unit prior to sending the notification to the network management agent.

107. (NEW) The article of manufacture of claim 102 further comprising:

prioritizing the events with other events reported by other line cards at the DSLAM control unit prior to sending the notification to the network management agent.

108. (NEW) The article of manufacture of claim 102 further comprising:

correlating the events with other events reported by other DSLAM control units at the network management agent.

109. (NEW) The article of manufacture of claim 102 further comprising:

prioritizing the events with other events reported by other DSLAM control units at the network management agent.

110. (NEW) The article of manufacture of claim 102 wherein an event is an observed change in a signal-to-noise ratio on a line.

111. (NEW) The article of manufacture of claim 102 wherein an event is a change in a bit error rate.

112. (NEW) The article of manufacture of claim 102 wherein an event is a change in any measurement of signal quality.

113. (NEW) The article of manufacture of claim 102 wherein an event is a change in a transmitter's signal power on a line.

114. (NEW) The article of manufacture of claim 102 wherein an event is a change in a transmitted bit rate speed for a line.